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3. A training in those branches of knowledge which have to do with the **economical** adaptation of means to ends.

4. A perception of the true relations of things, or a sense of proportion, which will indicate what measures or projects that are physically possible will really conduce to the **use and convenience of man**.

"In considering the personal qualifications which an engineer should possess," says Mr. Swain, "it is difficult to make a distinction between those which are particularly necessary for the engineer and those which are necessary for success in any field of endeavor. . . . There are some, however, which, while also requisite to a greater or less degree in any field, may be specially mentioned as desirable for the engineer. These are judgment, balance, a trained mind, experience, initiative, good health, and knowledge."

The necessity for proper instruction "in the fundamental principles which underlie the practice of the profession" is emphatically brought out in the discussion of engineering education. "The college cannot make a man an engineer, but it can afford the opportunity to gain that knowledge and discipline which will enable him to advance in his profession much more rapidly than he could without it. In addition to a technical education, it is, of course, extremely desirable that the engineer, like any other professional man, should have an acquaintance, and not a superficial one, with history, language and literature, with economic and social problems, and with the natural sciences. The true object of education cannot be attained without effort. When the work of a student is easy for him, it should be changed. It should always be within his powers, but it should require continued effort."

Mr. Swain is not in sympathy with the proposal that engineering students be required to take a preliminary college course in arts. "From the writer's experience of more than thirty years, in plain English, the 'thorough training' which is so often claimed, by educators, to have been obtained by college and engineering graduates, is a fallacy. A few men get it, all have the opportunity to get it, but the majority do not get it. It depends on the student. The diploma is no guarantee that he has it."

Rather than a longer course of combined technical and liberal subjects, Mr. Swain recommends an undergraduate course of four years and post-graduate work leading to advanced degrees. "Enter an engineering school as soon as you are prepared, and get the habit of **work** at once—and not only the habit of work, but train yourself to work **effectively**. Hard work will not help you much if it is ineffective and does not lead to results. . . . Broaden yourself as much as possible. Acquaint yourself with the great men who have gone before; learn what they did and said and thought, and relate all this to your own experience and aims. Read the classics in the best translations you can find. Learn to use the English language well and to

(Continued on page 30)

The Engineer's Bookshelf

The Young Man and Civil Engineering by George Fillmore Swain, Professor of Civil Engineering, Harvard University; a Past-President of the American Society of Civil Engineers. The MacMillan Company, New York. Price \$2.00.

The Young Man and Civil Engineering is "designed to offer competent advice to young men upon the verge of choosing a profession." In direct and vigorous style, Mr. Swain seeks first an adequate definition of engineering, and suggests the following: "Engineering is the science and art of applying, economically, the laws, forces, and materials of nature, for the use, convenience, or enjoyment of man." He finds that "civil engineering is the parent stem which at first included all branches of the constructive art, with the exception of military engineering." From this original stem have grown architectural engineering, mechanical engineering, electrical engineering, mining and metallurgical engineering. "In the last analysis, members of all these professions belong to the one great profession of engineering, but for practical purposes it is desirable and usual to consider them as distinct."

The prospective engineer must decide whether or not he possesses the necessary professional and personal qualifications. Mr. Swain's list of professional qualifications is as follows:

1. A knowledge of the forces of nature, and of the laws governing them; in other words, a knowledge of natural science, logic, and mathematics.

2. A knowledge of the materials applicable in construction.

THE ENGINEERS' BOOKSHELF

(Continued from page 19)

Speak in public without embarrassment. Extend your technical education over more than four years if you can do so profitably, but not too long, for too much school education is as bad as too little, and probably worse. Your real education will come later anyway."

For the young man who is not sure that he wants to continue in the profession of engineering, there is comfort in the statement that "an engineering training is the best preparation for any walk of life, and that if a college course is taken it should be mainly devoted to science, the classics, history, logic and mathematics."

Civil engineering appeals to many young men on account of its general healthfulness and of the opportunities which it offers to do constructive and enduring work. "Most of the disadvantages that have been claimed with reference to civil engineering are disadvantages of the individual rather than of the profession." A large number of engineers have won both fame and fortune in practice, and the future presents a bright field for service and success.

In the concluding chapter friendly advice is given on such points as training one's self in observation, smoking during working hours, and ethics for engineers. The young man who takes time to read this delightful little volume will find therein much that is stimulating and helpful to him in choosing his life work.